

- (e) **Fuse Holders and Fuses.** Make fuse holders either in-line or Y-type connectors as shown on the Plans; make sure they are waterproof and self-insulating, and have a quick disconnect breakaway feature on the load side, if specified. Install a Y-type fuse holder at the base of each pole or overhead sign structure complete with the properly sized fuse. If specified on the Plans, branch circuits shall have an in-line fuse holder and fuse.
- (f) **Testing.** Test the installed electrical conductors in accordance with Section 805.

#### **811.05. METHOD OF MEASUREMENT.**

The electrical conductors will be measured by the linear foot (meter) for each of the various sizes and types specified, installed and shall include all connectors, fuses, splices, taps, and incidentals necessary to complete the electrical system as provided on the Plans.

#### **811.06. BASIS OF PAYMENT.**

The accepted *electrical conductors*, measured as provided above, will be paid for at the contract unit price as follows:

ELECTRICAL CONDUCTOR ..... LINEAR FOOT (METER)

Such payment shall be full compensation for furnishing all materials, equipment, labor, and incidentals required to complete the work as specified.

### **SECTION 812 HIGH MAST POLES**

#### **812.01. DESCRIPTION.**

This work shall consist of furnishing materials and installing of high mast poles in accordance with these specifications and details shown on the Plans or established by the Engineer.

#### **812.02. MATERIALS.**

Before the notice to proceed is issued, and before starting work, submit 8 copies, in brochure form, of a schedule of materials and equipment items proposed for the project. Include brand names, catalogue numbers, descriptions, cuts, shop and design drawings, and calculations as may serve to establish compliance with these specifications. (Materials normally used in highway construction and covered by the Standard Specifications, as to requirements, sampling and acceptance, need not be included in the schedules.)

*NOTE: It is the Contractor's responsibility to hold the manufacturer responsible for the correctness of dimensions and details on the design drawings. Approval of such drawings will not relieve the manufacturer of this responsibility.*

##### **(a) Structural Design.**

1. The design of the high mast poles covered by these specifications shall be the responsibility of the manufacturer. High mast poles shall be designed for a minimum of 80 mph (130 km/hr) wind velocity in accordance with the current edition of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals." The wind loads,

allowable stresses, etc., shall be in compliance with the above specifications. The Oklahoma Department of Transportation reserves the right to check any pole design at random.

*NOTE: Noncompliance with the above mentioned AASHTO Standard Specifications shall be cause for rejection.*

2. The pole manufacturer shall certify in writing that he has coordinated his design with the manufacturer of the high mast lowering device and will accept the installation of the high mast lowering device and luminaire to insure the proper function of the total system mechanically, electrically, and in all other respects.
3. The high mast pole shall be designed for a maximum deflection not to exceed 10 percent of the pole height.

**(b) Fabrication of Steel Shafts.**

1. The shaft shall be fabricated from a high-strength steel conforming to Section C of this Specification. The shaft may be either circular many-sided construction of the lengths shown or in telescoping sections. The sections shall be cold formed. The shaft shall taper uniformly from top to bottom. All galvanized poles shall be telescoping sections.

If a single welded unit shaft is furnished and, because of hauling restrictions, the shaft cannot be shop fabricated in one piece, a field weld will be allowed. This field welding shall be done by AWS certified welders working for and under the direct supervision of the pole manufacturer. If the shaft is furnished in telescoping section, the number of sections shall not exceed 5 for shafts 120 feet (36m) or less, and shall not exceed 6 for shafts up to and including 150 feet (46m).

The telescoping section may be fabricated either as a one piece unit or as a multipiece unit of not more than 2 pieces. One piece or multipiece sections shall be fabricated of pieces with a minimum length of 10 feet (3m). All pieces shall be butt welded in accordance with Paragraph 2(b), "Welds."

Each shaft section shall be fabricated so that it may be telescoped over the next lower section a minimum of 1-1/2 times the diameter of the female end of the joint. Telescoping sections shall be prefitted and matchmarked by the manufacturer. Each telescoping joint shall be preassembled to insure a proper fit. Field assembly of the telescoping section shall be as recommended by the manufacturer and in a manner approved by the Engineer.

*NOTE: No racking shall be allowed, and the manufacturer shall guarantee in writing that no settling of the joints shall occur.*

Each shaft shall be fabricated with a hand hole, complete with a weatherproof cover bolted to a reinforced frame or to a laminated shaft section. A reinforced frame or laminated shaft section shall restore the strength lost by the removal of metal for the hand hole. The circuit breaker and winch bracket mounting plate shall be provided opposite the hand hole.

Each shaft shall be provided with a grounding connection inside near the base of the pole.

The pole manufacturer shall meet Standard Manufacturing Tolerance for straightness of the pole shaft.

The use of laminated or layered steel plates in fabricating the shaft section may be allowed, if it meets the structural requirements of this specification and has been approved by the Bridge Engineer prior to fabrication. The minimum thickness of the shaft sections may be either 3/16 inch (4.76mm) plate or 7 gauge sheet.

2. Welds.

- (a) All welding shall conform to the latest edition of the AASHTO "Standard Specifications for Highway Signs, Luminaires and Traffic Signals," as modified herein.
- (b) The shaft of single unit poles and multipiece telescoping sections shall be butt welded with backed up 100-percent penetration circumferential transverse welds and shall be ultrasonically inspected by the manufacturer. All circumferential transverse welds, except the base plate connection, shall be ground flush to + 1/8 inch, - 0 inch (+3.18mm, -0mm). Backup material must be contoured for full contact, continuous, and of the same material as the shaft.
- (c) Each shaft may have a maximum of two longitudinal electric welds with 60 percent minimum penetration. The weld may be ground or rolled flush and smooth.
- (d) The shaft shall be welded to the steel base by either two continuous welds, one at the top of the base and one at the bottom of the shaft, or by full penetration butt welds with a suitable backup strip, if necessary. The size and spacing of the welds shall be such as to develop the full resisting moment of the shaft.
- (e) No field welds shall be permitted, except as noted in Paragraph (B) 1, "Fabrication of Steel Shafts."
- (f) All welds shall be visually inspected and tested by one of the following methods: (1) ultrasonic method of AWS D1.1 including revisions, (2) magnetic particle method to ASTM E-709, or (3) radiographics method to ASTM E-94, E-390 or E-142-92, as applicable. Certified results shall be submitted for the Engineer's review. All field welds shall be tested 100 percent. All weld testing shall be at the expense of the manufacturer.
- (g) All weld splatter shall be thoroughly removed before finishing.
- (h) All welding shall be done before galvanizing.
- (i) All weld metal shall meet the notch-toughness requirements as specified for bridge application in AWS D1.1 including revisions. Impact tests in accordance with Appendix C of AWS D1.1 are required for electroslag and electrogas weld metal.

(c) **Mechanical Properties.**

- 1. Any high-strength steel supplied for the shaft shall have a minimum yield strength of 48,000 psi (331 MPa) and shall meet the notch-toughness requirements of the Charpy "V" Notch Test for 15 ft•lbs at 40°F ( 2.08 kg•m at 4.4°C). Four copies of the manufacturer's certified mill test report (chemical and physical properties) covering each heat used on the project shall be submitted to the Engineer. A minimum of 3 coupons shall be tested for each heat after rolling by the steel manufacturer. Any sample showing less than the minimum yield strength shall be retested from the same heat. Failure to the second test is cause for rejection.
- 2. All base flanges, brackets, and miscellaneous hardware shall be fabricated from steel plate and shall have a minimum yield strength of 36,000 psi (248.2 Mpa).

3. Anchor Bolts.
  - (a) Each high mast pole shall be furnished with a minimum of 6 anchor bolts.
  - (b) Anchor bolts shall be shipped prior to the pole and shall be caged before installation in the excavated foundation hole.
  - (c) A template shall be provided to insure the proper fit of the pole base on the anchor bolts.
  - (d) Anchor bolts and nuts installed with galvanized poles shall be galvanized in accordance with ASTM A-153-82 (AASHTO M-232) a minimum of the threaded length plus 6 inches (75 mm) and comply with ASTM A-143-74 for prevention of embrittlement. Certification shall be provided at the request of the Engineer.
  - (e) Anchor bolts may not be welded to make the required lengths, nor shall they be tacked or welded to make up the anchor cage.
  - (f) Anchor bolts shall be torqued as specified by the pole manufacturer.
  - (g) Each anchor bolt shall be supplied with three hex nuts, one of which shall be a lock nut.
4. Finish.
  - (a) If specified on the Plans, the shaft, base and miscellaneous brackets shall be galvanized in accordance with ASTM A-123-89a (AASHTO M-111-94). Precautions shall be taken against embrittlement, warpage and distortion in accordance with ASTM A-143-74 and ASTM A-384-76. Certification shall be provided at the request of the Engineer.
  - (b) Care shall be taken not to scratch the pole finish prior to and during erection. However, if the finish is damaged, it shall be repaired in accordance with recommended materials and procedures established by the manufacturer of the finish and the pole and approved by the Engineer.

#### **812.04. CONSTRUCTION METHODS.**

1. Join together shafts made of telescoping sections before erection, in a manner recommended by the pole manufacturer and approved by the Engineer.
2. Plumb and verify shafts in at least two directions, 90 degrees apart, with a transit. Plumb at the time of day approved by the Engineer and within a tolerance of one-half of the pole top diameter.
3. Fill the void between the base plate and top of the foundation with an approved nonshrinking grout only after inspection and approval by the Engineer. Provide the grout with a drain hole of adequate size and location to drain any moisture accumulated inside the pole.
4. As an alternative to grout, install a heavy gauge galvanized sheet steel formed to fit the hole inside the base plate and of sufficient width to enclose the void between the base plate and foundation.. In this case, fasten the sheet steel in place in such a manner as to prevent entry by either rodents or vandals.
5. Install the high mast lowering device prior to erection of the pole. Take care to not damage the lowering device during installation.

**812.05. METHOD OF MEASUREMENT.**

*High mast poles* will be measured by each unit of the size and finish specified, installed in place, complete with all accessories and attachments.

**812.06. BASIS OF PAYMENT.**

The accepted high mast poles, measured as provided above, will be paid for at the contract unit price bid as follows:

HIGH MAST POLE ..... EACH

Such payment shall be full compensation for furnishing all materials, equipment, labor, and incidentals required for completing the work as specified.

## **SECTION 813 HIGH MAST LOWERING DEVICE**

**813.01. DESCRIPTION.**

This work shall consist of furnishing materials and installing of a raise and lower device in accordance with these Specifications and details shown on the Plans or established by the Engineer.

**813.02. MATERIALS.**

Prior to starting work, submit to the Engineer 5 copies, in brochure form of the bill of materials and equipment replacement parts list for items proposed for the project. Also include 5 copies of the service manual and operating manual. Include in the schedule part brand names, catalogue numbers, descriptions, cuts, diagrams and shop drawings, with all part numbers and materials finishes labeled, as may serve to establish compliance with these Specifications. (Materials normally used in highway construction and covered by the Standard Specifications as to requirements, sampling, and acceptance need not be included in the schedules.)

The lowering device manufacturer shall have manufactured and satisfactorily installed this a minimum of 5 years, unless otherwise approved by the Design Engineer. Final acceptance of any submitted lowering device design will rest solely with the Design Engineer.

(a) **Structural Design.**

1. The lowering device shall be of proven design, construction, and materials that will assure a long, reliable, safe, and low-maintenance life.
2. The lowering device shall lower a ring of luminaires to within approximately 3 feet (1m) of the pole base so that routine luminaire maintenance can be accomplished safely and efficiently.
3. There shall be facilities to energize the entire ring of luminaires while the lowering device is in the lowered position. Each pole shall be supplied with a power cable and connectors for this purpose. The service receptacle for this cable shall be weatherproof, twistlock, rated at 600 volts.